B U L L E T I N

of the

United States Institute for Textile Research, Inc.

Vol. I November, 1931 No. 9

C O N T E N T S

Second Annual Meeting
Resolutions on Death of Dr. S. W. Stratton
Research Sub-Committee Appointments
"Research: A Stabilizing Influence on Industry"
Address of Dr. C. H. Herty at annual meeting
Yarn Numbering Balance of Torsion Type That
Corrects for Moisture Regain
U. S. Institute Committee Meetings
Abstracts
Bibliography
"Survey of Textile Research in the United States, 1931"
Summary of Survey Results

Secretary's Temporary Office
65 Franklin St., Boston, Mass.

T. R. I. BULLETIN

An Official Publication of
United States Institute for Textile Research, Inc.

Vol. I November, 1931 No. 9

SECOND ANNUAL MEETING

The second annual meeting of the members of the corporation, held at the Chemists' Club, New York City, Thursday, November 5, was saddened by the recent death of our first President, Dr. Samuel Wesley Stratton, but the spirit of the meeting and of the organization's reaction to this great loss is reflected in the following pledge contained in the resolutions adopted unanimously in his memory: "The members of this corporation will endeavor to perpetuate the memory of their first President by carrying his valuable work for them to the successful conclusion that he had envisioned."

Thirty-two members and guests were present, and, in accordance with the suggestion of our late President, the formal business program was started before the luncheon and sandwiched between its courses. First Vice-President Thomas T. Clark, who becomes the Acting-President, presided and Dr. E. H. Killheffer acted as toastmaster in introducing his friend, the guest-speaker, Dr. Charles Holmes Herty.

Could Not Accept Presidency

Dr. Killheffer's introduction disclosed the fact that he had been designated by the Board of Directors to try to induce Dr. Herty to accept nomination as Dr. Stratton's successor. His report and remarks were as follows: "I really had hoped to say a little bit more about Dr. Herty, but I find that the ear on Dr. Herty's right apparently has been affected, so that he doesn't hear so good in that ear. I had the same experience before with either the right ear or the left, or maybe he had a convenient deafness when I talked to him once before about the leadership of this, our organization. But even tho his hearing is bad it can do no harm to express the wish of a great many of us that he could see his way clear to come with us and lend us some of his great abilities in the very field that this organization needs very greatly, particularly now that its first president, Dr. Stratton, has been called from us. The organization needs very greatly just the kind of council and leadership that I know Dr. Herty could give it if he would or could."

Dr. Herty expressed appreciation of the honor thus accorded him, especially that he should be considered as Dr. Stratton's successor, and explained in some detail why pressure of his pine-pulp research and his consulting work prevented his assuming additional duties, stating also that he would not be willing to head up an organization like U. S. Institute and not take an active part in its work. An abstract of Dr. Herty's address on "Research--A Stabilizing Influence on Industry" will be found on another page. At its conclusion he was given a rising vote of thanks, and Dr. Killheffer in seconding stated that practically everything Dr. Herty had said in his address emphasized his especial fitness for the presidency of U. S. Institute.

- - - - - -

Annual and Special Reports

The annual report of the Executive Committee, including those of the Treasurer and Auditor, and the annual report of the Secretary were distributed in mimeograph form at the meeting, and are being forwarded with this issue of T. R. I. Bulletin to those members of U. S. Institute who were not present at the annual meeting.

In the unavoidable absence of Chairman Emley of the Research Committee, and of Prof. E. R. Schwarz of that committee and the Massachusetts Institute of Technology, the Secretary read a report of the first piece of research completed by a cooperating laboratory of U. S. Institute on a problem assigned by the latter. This torsion balance yarn numbering scale that corrects for moisture regain is described in this issue.

New Directors Elected

E. N. Hood, Alban Eavenson and Dr. E. H. Killheffer had been appointed by the Acting-President as a committee on nominations of new directors and presented the following ticket which was elected by the Secretary casting one ballot: Three-Year Class.- Charles B. Nichols, Walter C. Taylor, Allen R. Mitchell, Jr., P. J. Wood, Philip A. Johnson, H. V. R. Scheel and Dr. E. H. Killheffer, reelected, and Charles H. Clark to succeed W. F. Edwards, resigned.

For Two Years.- K. P. Lewis to succeed C. W. Causey, resigned; Robert R. West to succeed H. R. Fitzgerald, deceased; Jno. W. Arrington to succeed Dr. S. W. Stratton, deceased.

Mr. Lewis is secretary and treasurer of the Erwin Cotton Mills Company, Durham, N. C.; Mr. West is vice-president and production manager of the Riverside & Dan River Cotton Mills, Danville, Va., and Mr. Arrington is president of the Union Bleachery, Greenville, S. C.

New Officers Elected

At the first quarterly meeting of the new Board of Directors, immediately following the meeting of the corporation, no action was taken on a successor to Dr. Stratton other than to direct the Executive Committee to assume the responsibility of studying and reporting on this important matter. In the meantime, and in accordance with the by-laws, the President's duties will be performed by the First Vice-President, Thomas T. Clark.

The new officers elected were as follows: Vice-Presidents.- Thomas T. Clark, A. F. Bemis, W. R. Blum, H. V. R. Scheel and K. P. Lewis. Mr. Lewis succeeded H. R. Fitzgerald, deceased, all of the other Vice-Presidents being reelected, excepting E. A. Clements, resigned, which vacancy was not filled.

Treasurer, E. N. Hood, reelected.
Secretary, C. H. Clark, reelected.

Executive Committee: For Three Years.- H.V.R.Scheel and Dr. E. H.Killheffer. For Two Years.- P. A. Johnson, succeeding C. W. Causey, resigned. For One Year.- Alban Eavenson, succeeding E. A. Clements, resigned. The other two members of the committee are Thomas T. Clark and E. N. Hood, their terms continuing for two years and one year, respectively.

- - - - - -

RESOLUTIONS ON DEATH OF DR. S. W. STRATTON

Adopted by Members of U. S. Institute
November 5, 1931.

WHEREAS, United States Institute for Textile Research, Inc., suffered the loss of its first president, Dr. Samuel Wesley Stratton, by his untimely passing, October 18, 1931, and

WHEREAS, Dr. Stratton's reputation as an eminent physicist, as the creator of one of the world's greatest research institutions in the Bureau of Standards, and as president and later chairman of the corporation of Massachusetts Institute of Technology, rendered his acceptance of the presidency of United States Institute for Textile Research, Inc., an endorsement of unusual value and importance to this young organization, and

WHEREAS, the Board of Directors and members of United States Institute for Textile Research, Inc., are highly appreciative of the great debt owed to Dr. Stratton for the endorsement of the corporation by his acceptance of its presidency, and for the leadership that he gave liberally and gratuitously for nearly a year, and are equally appreciative of his sterling personal qualities, therefore, be it

RESOLVED, that the Board of Directors and members of the corporation of United States Institute for Textile Research, Inc., do hereby extend to Dr. Stratton's sisters, to his associate, Mr. Morris A. Parris, and to his colleagues of the corporation and faculty of Massachusetts Institute of Technology, their sympathetic condolences in their loss, and the assurance that, as far as it lies within their power, the members of this corporation will endeavor to perpetuate the memory of their first President by carrying his valuable work for them to the successful conclusion that he had envisioned.

Adopted unanimously this, the fifth day of November, Nineteen hundred and thirty-one at the annual meeting of members of the corporation of United States Institute for Textile Research, Inc., New York City.

- - - - - -

RESEARCH SUB-COMMITTEE APPOINTMENTS

Chairman Emley of the Research Committee announces the appointment of Prof. E. R. Schwarz as chairman of the sub-committee on Abstracts and Bibliography, succeeding Dr. W. F. Edwards, resigned, and of Prof. Louis A. Olney as a member of that committee. The other members are Dr. Emley and E. D. Walen. This sub-committee has been designated as the board of editors of the projected Annual, "Textile Research Progress."

To succeed Prof. Schwarz as chairman of the sub-committee on Contact With Industry, Dr. Emley has appointed the Secretary of U. S. Institute.

Paul T. Cherrington, merchandising counselor, New York City, has accepted membership on the sub-committee on Economic Research. The other members are H. V. R. Scheel, chairman, A. W. Zelomek and F. S. Blanchard.

- - - - - -

"RESEARCH: A STABILIZING INFLUENCE ON INDUSTRY"

Abstract of Address of Dr. Charles H. Herty
Reprint From Textile World of Nov. 14

There is a sharp contrast between the attitude toward research during the present depression and that manifested during the depression of 1921-22. Immediately following the war, there was a tremendous outgrowth of research in this country. Then panic struck us in 1921 and 1922, and swept nearly all that research off the board. Tremendous programs were wiped out, indicating that the seed of research had been sown on rather stony ground.

Compare that disaster with the present depression. Undoubtedly a great many research staffs have been curtailed--but there has been no such wiping out of research programs as developed in 1922. This is evidence that we have made real progress as to appreciation of the importance of industrial research. What happened to bring about this change?

Research in Petroleum Industry

Take the petroleum industry: In 1925 or 1926 I was shown a report on research which had been lying buried in that industry's files for two years. We got some action on this report and soon had a fund of $500,000 which was farmed out to universities. After this money was secured, the 120 problems outlined in the aforementioned report were gone over by two of the leading men in the field. They threw out only two problems--and those because these men thought they were too practical. In other words, they wanted to keep the fund employed on fundamental problems. Since that time the work has been producing exceedingly interesting results.

In the Steel Industry

Take another field: Five years ago there was no real appreciation of research in the steel industry. But on Oct. 16, this year, there was held in Pittsburgh an open meeting of the advisory committee on research, attended by 410 of the leading men in the field, who had journeyed to Pittsburgh, for just one day, to listen to reports of progress in research done by the Bureau of Mines, the Carnegie Institute of Technology and 44 steel companies, on technical problems in steel manufacture. Five years ago, it would have been impossible to get a dozen men there.

In the Paper Industry

Finally, I shall cite the paper industry. Admittedly backward in research in the past, it has begun to wake up. At Appleton, Wisc., under the leadership of paper makers who have felt the need of training research men for the paper industry, there has been established an institute for paper chemistry in connection with Lawrence College. A new building has been erected and equipment manufacturers have installed the best types of machinery.

In the Textile Industry

These are merely a few examples. In other words, industry seems to be getting hold of the idea that real progress has got to be made with research leading the way.

Turning to the textile industry, there is a real possibility in connection with the Textile Foundation. (Dr. Herty then reviewed the background of the Textile Alliance fund which was the basis of the establishment of the Foundation.) I am glad to see that the directors turned to the U. S. Institute for Textile Research, for a survey of progress. It is also inspiring to reflect on the attitude evident at the meeting between textile men and research men a few months ago, which resulted in the establishment of a Foundation fund of $100,000 for fellowships, to answer the need of training men for the textile industry.

Industry and Government Must Cooperate

Finally, I want to discuss research as a stabilizing influence. I am a firm believer in the statement that, when growth stops, decay sets in. You can't be stable if you tend to go backwards.

A document I have here, written just a hundred years ago, points out the importance of prompt diffusion of statistical data to prevent alternative periods of scarcity and glut, with resulting harm to consumer and producer. And yet, it has just recently been decided to discontinue the annual dye census which represents the one admirable step ever taken by the Government to give an industry accurate information on which it could formulate its advance. It has been stated that this decision was made because the Tariff Commission was afraid it might be attacked later on the grounds that it was giving too much to one industry. Instead of taking this backward step, a forward step should be taken, and other industries given the information they need.

Of all the propositions as to what we should learn from the depression, I haven't seen the suggestion that the Government set up a statistical bureau so that all branches of industry could have regular and accurate reports on production, consumption, stocks, etc. There is not a manufacturer in this country who can't afford to set up an extra department, if necessary, and pay another man just to supply such information to the Government.

Congress has got to see this, and make appropriation for it--and industry has got to cooperate.

Research is the great means of preventing booms or depressions, and of bringing about stability. That is why I have emphasized the need of research along the lines of statistical information on production and consumption.

- - - - - -

YARN NUMBERING BALANCE OF TORSION TYPE THAT CORRECTS FOR MOISTURE REGAIN

(As Read at Annual Meeting, Nov. 5)

There has been developed in the textile laboratories of Massachusetts Institute of Technology, Cambridge, Mass., in connection with work on a research problem assigned to that cooperating laboratory by U. S. Institute, a torsion balance yarn numbering scale that for the first time provides correction for moisture regain.

It is the first piece of completed research to be reported by one of these cooperating laboratories, and the instrument thus to be made available to the industry is designed for routine mill testing of yarns, and not for refined research work.

The research leading up to the development of this scale was directed by E. R. Schwarz, assistant professor of textile technology at M. I. T., and a member of U. S. Institute's research committee. Prof. Schwarz describes the scale and its use as follows:

"The present quadrant balances for the determination of yarn number have variable division increment scales and are, therefore, difficult to read. They do not take into account the moisture regain present in the sample, and in order to obtain standard or comparable results, it is necessary to use them in a properly conditioned atmosphere and with properly conditioned samples.

"Balances on the torsion principle--a very desirable construction--are now obtainable with scales which give yarn number direct when a sample of definite length is used. In common with the above mentioned balances, however, they do not correct for moisture regain.

"Realizing the importance for control work in a mill and for laboratory testing not requiring high precision, it was proposed to design and construct a torsion balance which would take moisture regain into account. This was done experimentally on a model balance employing two separate weighing systems. One of these gives the weight of the sample direct in milligrams. It may, therefore, be used for any routine weighings of small samples within the capacity of the balance. A second scale and torsion system are provided and are so calibrated that when a definite weight (bone dry) of a yarn similar in general size and construction (within reason) to the material to be tested, is hung upon this system, any changes in moisture regain taking place within the sample will be registered on a scale. It is thus possible to take into account variations in regain from day to day or progressively throughout a day however great they may be in magnitude.

"It is assumed that the samples to be tested will have been in the neighborhood of the balance for a sufficient time to have reached equillibrium with whatever atmospheric conditions exist. The moisture regain in the test sample should be very closely equal to the regain existing in the master sample on the balance regain scale. By means of a mathematical relationship which is readily derivable, it is possible to convert the weight of a known

length of yarn at a known regain to the yarn number at any other desired regain or at bone dry conditions. A slide rule has been designed to free the operator of the instrument from the necessity for making any calibrations.

"A sample of the yarn whose number is to be determined is cut to length by means of a special template, or set of templates, furnished with the balance, there being a template, or template section, for cotton, wool, silk, etc. One or more lengths of this yarn (as specified in directions) are hung upon the hook of the main scale. This scale is brought into balance and the weight indicated is read. At the same time the regain scale reading is noted. These two figures are set on the slide rule and an index points to the corrected weight and to the corrected yarn number for any degree of regain required. The essentials of the design of this balance have been completed and work is now in progress on its construction by a leading manufacturer in this field. It is believed that the slide rule may be substantially simplified and work is now in progress to this end.

"For mill laboratory use in the routine testing of yarns utilization of such an instrument not only obviates the uncertainties due to lack of correction for moisture but greatly reduces the length of time now required when a drying oven and ordinary balances are used. In view of the fact that the cost of this instrument is not likely to be excessive and that it will serve as an accurate balance for general use in addition to its specific capacity as a yarn numbering scale, we believe it to be an important item of interest to the textile industry.

"While the design and test work preliminary to actual quantity production is substantially complete, there will remain, of course, final approval of the completed instrument and tests for its acceptance which we propose to carry out."

- - - - - -

U. S. INSTITUTE COMMITTEE MEETINGS

The next meeting of the Executive Committee is tentatively scheduled for the morning of December 4 at the University Club, Boston, Mass. Call for the meeting will be mailed November 23, and, because of the importance of the agenda, all members of the Board of Directors will be invited.

The Research Committee has been invited to hold its next meeting in December at the Lowell (Mass.) Textile Institute, Prof. H. J. Ball of that institution having charge of the arrangements.

The committee on Membership Promotion, of which H. V. R. Scheel is chairman, is planning a series of luncheon meetings to be held in the principal textile cities, North and South, that will be designed to promote interest in textile research as well as Institute membership. These meetings of small selected groups will take the place of the larger campaign originally planned.

- - - - - -

CLASSIFIED INDEX
of
Abstracts and Bibliography
(Arranged Alphabetically by Major Subject)

	Page
Fibres (Synthetic and Natural) and Fibre Analysis	
Artificial Fibres Containing Nitrogen.	13
Comparative Research on Characteristics of Cellulose Acetate and the Artificial Fibres Manufactured From It.	16
Development of Mildew on Wool.	17
Observations on the Apparent Fineness and Freedom from Kemp of Naturally-Coloured Wools.	13
Practical Identification of Acetate Rayon.	17
Rayon Identification.	9
Studies of Viscose Cross Sections (concl.).	15
Yucca, A New German Fibre Plant (concl.).	16
Yarns and Fabrics	
Fabrics: Strength Testing.	14
Formation of "Diamond Spot" Stains by Mildew Fungi.	13
Kinematics of Twist. I. The Definition of Twist.	14
Porosity: A Primary Property of Textiles. V. Porosity of Fabrics and Penetration Problems.	14
Relation Between the Twist and Certain Properties of Rayon Yarns.	9
Research in Flax Yarn Finishing (cont'd.).	16
Yarn: Comparative Strength Tests.	14
Chemical and Other Processing (Not Otherwise Classified)	
Analysis of Turkey-Red Oils.	17
Bleaching of Silk with Hydrogen Peroxide.	12
Determination of Starch in Sized and Finished Cotton Goods.	12
Determination of Total Size or Filling in Cotton Goods.	11
Enzymes and Their Applications in the Textile Industries.	17
On the Use of Hydrogen Peroxide in the Textile Industry.	16
Starch: Zymolysis.	15
Research Methods and Apparatus	
Abrasion Tester.	10
Blancometer for Specifying Nearly White Colours.	10
Color, Its Appearance and Measurement.	16
Color Measurements in Psychological Terms.	16
Colorimeter for Use with Disc Mixture.	9
Fibre Projection Microscope.	9
Interrelation of Various Aspects of Color Vision.	12
Maintenance of Relative Humidities on a Laboratory Scale.	16
New Aid in Color Matching.	17
New Design of Microscope.	10
New Humidity Meter on Psychrometric Principle.	12
Simple Method for the Calculation of the Denier and Other Systems of Numbering.	13
Step-Photometer as an Aid to Textile Chemical Research.	16
Economics and Miscellany	
Scientists and Industry.	9
Suggestions for Practical Nomenclature Founded Upon Scientific and Exhaustive Researches for the Silk and Rayon Industries	10

ABSTRACTS

RAYON IDENTIFICATION.
American Dyestuff Reporter, Vol. XX-20, Oct. 12, 1931, P. 662-667.

This is a tentative report of the rayon sub-committee of the American Association of Textile Chemists and Colorists and is a decided step forward in the matter of fibre identification. It includes not only color-meter tests and the usual tests such as burning but a discussion of the longitudinal and cross-sectional method of microscopic analysis and includes the delustred rayons as well as the other types. The electro-scope is rejected by the committee as unreliable. The committee also emphasizes the importance of comparison of the specimen with known samples and further states that it is not possible to positively identify trade brands of rayon produced under any particular process. (S.

- - -

A COLORIMETER FOR USE WITH DISC MIXTURE.- Dorothy Nickerson.
Journal of the Optical Society of America, Oct., 1931, P. 640-642.

This is a paper presented before the Optical Society, February 27, 1931 and describes the construction and optical system of a colorimeter built with the cooperation of the Keuffel & Esser Company. The standard of comparison is a disk mixture of Munsell papers and either large or small areas of masses of fibrous material may be studied. Areas up to 12" in diameter are easily handled. (S)

- - -

RELATION BETWEEN THE TWIST AND CERTAIN PROPERTIES OF RAYON YARNS.- Homer A. Hamm and Richard S. Cleveland.
Bureau of Standards Journal of Research, Vol. 7-4, Oct., 1931, P. 617-620.

The results of a systematic experimental study of the relation between twist and certain physical properties of rayon yarns are given. In general the breaking strength determined by the multiple-strand method is not materially affected by an increase in twist up to about 20 turns per inch, but it decreases rapidly with an increase in twist beyond 20 turns. The proportional limit decreases with an increase in the amount of twist. The stretch at break decreases somewhat with increase in twist. The denier increases with increase in twist. The contraction resulting from twisting rayon yarn is greater for lower tensions and for higher deniers. (S)

- - -

THE SCIENTISTS AND INDUSTRY.
Textile Manufacturer, Vol. LVII-682, Oct., 1931, P. 353-356.

A series of abstracts of papers read at the Centenary Meeting of the British Association for the Advancement of Science. The following papers are covered:

Rationalization and the Cotton Industry.- J. Morris.
The Effectiveness of Labour Incentives.- C. A.Lee.
Some Observations on Immediate Colour Memory.- Mary Collins.
Cotton Production.- Sir James Currie.
The Utilization of Wool.- S. G. Barker. (S) (S)

- - -

FIBRE PROJECTION MICROSCOPE.- B. Schulze.
'Papier-Fabrikant,' 1931, 29.

The disadvantages of the usual method of measuring the dimensions of fibres by means of the microscope are pointed out and a simple projection apparatus is described. Notes are given on the method of making measurements and on the preparation of the fibre samples. (Copied complete from The Instrument World, Sept., 1931.) (S)

- - -

THE BLANCOMETER FOR SPECIFYING NEARLY WHITE COLOURS.
Textile Manufacturer, Vol. 57-681, Sept., 1931, P. 325-326.

Another application of the photo-electric cell to the measurement of color. The apparatus is covered in British Patent Specification No.324351 by Adam Hilger Ltd. By means of three special filters of broad transmission range the reflection or transmission coefficients relative to standard white, as determined for the three corresponding portions of the spectrum, denote the color in a practical manner. A photo of the instrument is given together with two drawings illustrative of the lay-out of the optical system.

Light is reflected into a photo-electric cell from the test surface after passing through two photo-meter wedges, and alternatively from a standard nagnesium-oxide surface after passing through two wedges. Readings of the deflection of a meter indicating changes in current due to the fluctuations of the intensity of the light reaching the cell can then be made. A typical set of readings are given below.

	Observations	% Reflection
Red	796.77	91.6
Green	797.23	90.0
Blue	800.67	77.2
White	797.60	88.4

The above or similar sets of readings serve to specify for all practical purposes the color of a nearly white object. (S)

- - -

ABRASION TESTER.- L. Schopper.
Melliand Textile Monthly, 1931, No. 12, P. 1572-1573.

The Schopper abrasion tester, Model 1530, is from the designs of Dr. Herzog and Dr. Geiger. The apparatus is for both heavy and light fabrics, an outstanding feature being that it subjects the test sample to a combined rotary and rolling motion, instead of to a straight one-way friction. Its action and operation are briefly described. (Copied complete from The Instrument World, Sept., 1931.) (S)

- - -

A NEW DESIGN OF MICROSCOPE.-
The Photo. Journal, Aug., 1931, P. 318.

The microscope has a four-legged stand, and by means of a lever the two back legs can be adjusted in order to incline the whole body of the microscope. The body tube, stage, condenser and mirror are all supported on separate fittings which clamp to a simple metal optical bench which is attached to the foot by being pinched between two metal plates. The microscope body tube is actuated by the coarse adjustment, and can be aligned by means of two adjustable screws. The stage is controlled by the fine adjustment. The condenser fits into a tube below the stage, and can be centered by means of centring screws. It can be focussed by sliding it in and out of its carrying tube, and by means of an additional fine adjustment actuated by a milled head. The condenser can be removed without disturbing the other parts of the microscope. The microscope is fitted with special objective changers, and instead of the usual spring clips for holding the object in position on the stage, pivoted levers are provided. (Copied complete from The Instrument World,Sept.,1931)(S)

- - -

SUGGESTIONS FOR PRACTICAL NOMENCLATURE FOUNDED UPON SCIENTIFIC AND EXHAUSTIVE RESEARCHES FOR THE SILK AND RAYON INDUSTRIES.- W. M. Kuhn.
Melliand Textile Monthly, Vol. III-8, Nov., 1931, P. 641-644 (to be cont'd.).

The beginning of a set of terms now being considered by the Textile Commission of the A. S. T. M., the textile committee of the A. S. M. E., and by the Bureau of Standards, is presented. The arrangement is alphabetical, starting with "appearance" and continuing through "yarn". Each term is explained and defined and wherever it is desirable the cause is noted. (S)

- - -

THE DETERMINATION OF TOTAL SIZE OR FILLING IN COTTON GOODS.- Douglas A. Glibbens and Arthur Geake.
Journal of the Textile Institute, Vol. XXII-10, Oct., 1931, P. T465-T474.

The paper contains a critical examination of several methods for total size analysis in grey cotton, as a result of which a standard procedure is recommended which is as follows:

The results obtained show that the malting process is the more efficient desizing treatment. In a convenient standard method of analysis for routine work it is desirable, however, to reduce the time of the desizing operation to a minimum, and to secure such a complete removal of clay that subsequent ashing is unnecessary. In the following method, which was finally adopted, the material is immersed in the solution of malt extract ("diastafor") for 15 minutes and is submitted to mechanical treatment during the malting. In the previous work the material was allowed to lie in the malting bath overnight, and it is chiefly in this respect, and in the omission of ashing, that the standard method now suggested differs from the experimental procedure first investigated (Page T470). It will be shown later that the standard method secures very effective desizing including the removal of clay. The detailed procedure is as follows:

A square of cloth weighing roughly five grams is cut from the sample, as much care as possible being taken to cut parallel to the warp and weft threads. The sides of the square are trimmed to a complete thread and five of these are then pulled out all round the square so as to leave a fringe, which enables the sample to be handled without the loss of yarn fragments. In the analysis of sized warp, a bundle of threads weighing about five grams is tied loosely round the middle, and particular care is taken to avoid the loss of loose threads during the washing operations. The sample (prepared square or yarn bundle) is weighed in its air-dry condition and a separate sample of about one gram is weighed out for moisture determination. The material for analysis is extraced for one hour with chloroform in a Sixhlet apparatus, and in routine work a number of samples may be loosely piled together in the extractor. The chloroform is allowed to dry off in the air and the cloth is well washed by alternate immersion in hot, running water and wringing by hand twelve times in succession. It is then alternately immersed in 0.5% diastafor solution (20 to 30 times the weight of cotton) at 50°C., and wrung by hand three times in succession, finally being returned to the solution, which is then heated to 70° C. The cloth is allowed to remain in the solution for 15 minutes in all; it is then well washed in hot, running water exactly as before, dried at 110° C side by side with the sample taken for the moisture determination, and both are weighed. It is of importance in this short desizing process to secure good penetration of the diastafor solution into the material, and this is achieved by hand wringing, which also assists the removal of clay.

The size content of the material is calculated from its loss of weight on desizing, its moisture content, and the desizing blank, for which the mean value 3% is adopted in the absence of unsized controls. In order to show clearly the basis upon which the blank corrections are made the actual laboratory record of weighings and calculations in an analysis by the standard method is given, as follows:

(1) Weighing bottle . . . . . (1)
(2) Do. plus air-dry cloth (prepared square) (2)
(3) Air-dry cloth . . . . . (2) - (1)
(4) Moisture contained in weight (3) of cloth calculated from separate moisture determination . . . . . (4)
(5) Oven-dry cloth . . . . . (3) - (4)
(6) Weighing bottle plus over-dry desized cloth . . . (6)

(7)	Oven-dry desized cloth	.(6) - (1)
(8)	Total size (uncorrected)	(5) - (7)
(9)	Blank correction	3% of (7)
(10)	Corrected total size	(8) - (9)
(11)	% total size on over-dry cloth	(10)x100/(5) (S)

- - -

A NEW HUMIDITY METER ON PSYCHROMETRIC PRINCIPLE.- F. Lieneweg.
Instruments, May, 1931 (from "Zeit. fur Feinmechanik und Prazision", Dec. 17, 1930, P. 1-7).

Instrument is suitable for plant operation, and for remote indication and control, indicating or recording relative and absolute humidity. The mercury thermometers of usual psychrometers are replaced by resistance thermometers, one of which is the wet-bulb. The current is measured by a cross-coil instrument so that the influence of voltage fluctuations is eliminated. The theory of this method is given. This instrument can be used over a wider temperature range than mercury thermometer instruments. It lends itself also well for the measurement of explosive gases. The accuracy is within + 3% for 10% to 100% humidity at temperatures from -5 to +120° C. Several types for measuring humidity of air and gases are described and illustrated. (Copied complete from The Instrument World, Sept., 1931) (S)

- - -

BLEACHING OF SILK WITH HYDROGEN PEROXIDE.- A. E. Weber.
Melliand Textile Monthly, Vol. III-8, Nov., 1931, P. 652-654.

The first installment of an article concerned with a description of certain experiments in silk bleaching. The present part covers the influence of the peroxide concentration on the bleaching of Tussah, the influence of the silicate, the influence of temperature on the velocity of the bleaching reaction. It is stated that a high temperature is of utmost importance in obtaining efficient bleaching on Tussah. For regular silks the temperature should not exceed 170° F., especially when the silicate is not properly controlled. (S)

- - -

THE INTERRELATION OF VARIOUS ASPECTS OF COLOR VISION.- Selig Hecht.
Journal of the Optical Society of America, Vol. XXI-10, Oct., 1931, P.615-639.

This is a paper presented at the New York meeting of the Optical Society, February 28, 1931 and covers the data of color vision; the discussion of a hypothetical color system; a discussion of color systems assuming color mixture data; hue discrimination and excitation curves; color sensations; and mathematical relationships. The paper is largely mathematical and includes several charts and tables together with a bibliography of some thirty items. It is stated that, assuming Young's trireceptor hypothesis as a basis for a theory of color vision, it is possible to show that the five aspects of normal color vision which have been accurately measured are quantitatively related to one another and may all be derived according to certain rules of computation from the spectral characteristics of the three primary receptor processes. (S)

- - -

THE DETERMINATION OF STARCH IN SIZED AND FINISHED COTTON GOODS.- Robert George Fargher and Leslie Vincent Lecomber.
Journal of the Textile Institute, Vol. XXII-10, Oct., 1931, P. T475-T487.

The determination of starch in yarn or cloth is essential for any control or experimental work on sizing, desizing or finishing, and for cloth analysis, particularly when it is desired to ascertain the ratio of antiseptic to starch. Despite its importance, however, the method of determination adopted is almost invariably indirect, the figure returned as starch being the total size or filling less the other ingredients which are found by analysis

to be present, so that any error in the analysis is reproduced in the starch content. Experiments were, therefore, initiated to find a more reliable and expeditious procedure. The most promising line of attack seemed to lie in converting the starch into glucose by a suitable mixture of diastases, and so obviating interference by other carbohydrates, gums, mucilages, etc. After an introduction the article discusses a procedure for the determination of starch by the iodine and by the copper methods; the reproducibility of the base test; the starch equivalents of different cottons and commercial starches and flours together with the other finishing substances; a comparison of direct and indirect starch measurements; and the conversion of starch into glucose by enzymes. (S)

- - -

ARTIFICIAL FIBRES CONTAINING NITROGEN.- Fritz Ohl.
Die Kunstseide, Oct., 1931, P. 347-352.

The manufacture on a large scale of an artificial fibre resembling natural silk is not yet possible. The properties of true silk and animal fibres are partially due to the fact that they contain nitrogen. The production of fibres containing nitrogen was often proposed without becoming practically important. The use of strongly degraded materials, complicated processes, after-treatments, etc., are decisive. Procedures involving high molecular proteins are promising. The spinning of primary acetate threads with appropriate nitrogen content is also advantageous, if the nitrogen content is maintained in the fibre without injurious secondary effects and without complication of the manufacturing process. With other properties the felting capacity of an artificial fibre containing nitrogen is pointed out. (S)

- - -

A SIMPLE METHOD FOR THE CALCULATION OF THE DENIER AND OTHER SYSTEMS OF NUMBERING.- K. Heinrich.
Die Kunstseide, Oct., 1931, P. 369-371.

It is demonstrated that, by the use of a simple diagram, the troublesome conversion of denier to another thread number can be avoided. The diagram itself is based on a logarithmic reticle or net, on which the relation of denier to other numberings is shown in lineal form, so that only straight lines and no curves have to be drawn. The design of this diagram and the diagram itself are dealt with in detail. (S)

- - -

OBSERVATIONS ON THE APPARENT FINENESS AND FREEDOM FROM KEMP OF NATURALLY-COLOURED WOOLS.- D. H. Strangeways and J. A. F. Roberts.
Journal of the Textile Institute, Vol. XXII-10, Oct., 1931, P. T488-T493.

It is stated that: (1) The apparent difference in fineness of wool fibres in the case of colored and white wools is not real. (2) In kempy wools the difference in appearance between the white and colored samples is very striking, but for the most part this difference, too, is unreal. (3) There is, however, a difference between colored and white kemp fibres. In proportion to their weight colored kemp fibres are finer than white ones. This difference is due to the fact that there is a larger proportion of cortex in colored kemp fibres than in the white. It must be emphasized, however, that the smaller diameter sometimes found in the case of black kemp fibres could only account for a small part of the large apparent difference when the kempiness of the sample is judged by eye. (S)

- - -

THE FORMATION OF "DIAMOND SPOT" STAINS BY MILDEW FUNGI.- Leslie D. Galloway.
Journal of the Textile Institute, Vol. XXII-10, Oct., 1931, P. T494-T496.

In fabrics exposed to damp conditions it is not uncommon to find that colored mildew stains develop in more or less definite squares, the diagonals of which correspond to the directions of warp and weft. In some instances

the shape is so clear cut that the name "Diamond Spot" has been given to it. "Diamond Spot" does not appear to be characteristic of any particular organism but depends upon the weave of the cloth. A plaster-of-paris reproduction of a woven structure was inoculated after preparation with an agar medium and the diamond formation appeared very perfectly outlined. (S)

- - -

YARN: COMPARATIVE STRENGTH TESTS.- L. Laurent.
Revue Test., 1931, 29, P. 601-607.

The practice of ignoring the highest and lowest values in determining the mean strength from a series of tests is discussed and the effect on the coefficient of regularity is shown in examples. The necessity for a large number of tests is emphasized and results are given for two yarns. It is pointed out that the proportion of tests giving values below the mean value is of great importance for comparisons of the resistance to breakage of different yarns. The precautions necessary when making comparative tests are outlined. (Copied complete from Abstract Section, Journal of the Textile Institute, Oct., 1931.) (S)

- - -

FABRICS: STRENGTH TESTING.
Textile Weekly, 1931, 7, P. 444.

The author shows by reference to tests on a plain cloth, a 2/2 twill, lingerie satin, and dress satin, with a horizontal tester of the pendulum type that the "edge effect" in cloth testing is independent of the width of the specimen. The effect can, therefore, be calculated from strength tests on specimens of two different widths, assuming that the equation $P = aw - e$ holds good, where P=observed breaking load, a is the true breaking load per unit width, w is the width, and e the "edge effect." (Copied complete from the Journal of the Textile Institute, Oct., 1931.) (S)

- - -

KINEMATICS OF TWIST. I.- THE DEFINITION OF TWIST.- H. J. Woods.
Journal of Textile Science, 1931, 4, 33-36.

In this article the author has obtained fundamental expressions for twist in yarns by drawing analogies with helices. For tortuous curves, the twist is shown to consist of two components--(1) The rate of change of the inclination of the transverse to the osculating plane $-\frac{d\phi}{ds}$; (2) The rate of rotation of the osculating plane about the tangent to the axial curve (a). Thus, if T is the total twist per length l of yarn, then

$$T = \int_0^l \left(a + -\frac{d\phi}{ds}\right) ds$$

An application of the above is made to the two processes of winding an untwisted yarn on to a bobbin by (1) rotating the bobbin axially, and (2) winding the yarn around a stationary bobbin. Process (2) has then $\pm$ one extra turn of twist per unit turn of winding over process (1). This explains the change of twist in yarns after passing through processes which involve no mechanical twisting of the yarn, e.g., reeling, etc. Similar considerations are applied to twofold yarns. (Copied complete from the Abstract Section, Journal of the Textile Institute, Oct., 1931.) (S)

- - -

POROSITY: A PRIMARY PROPERTY OF TEXTILES. V.- POROSITY OF FABRICS AND PENETRATION PROBLEMS.- J. Schofield.
J. Soc. Dyers and Col., 1931, 47, P. 166-168.

The porosity of a fabric is principally of two kinds--(1) The meshwork formed by the interlacings of the warp and weft; (2) The capillary channels between the fibres of the yarns. There is also intra-fibrillar porosity of

a minor order. Mesh porosity, capillary porosity, and penetration are discussed, reference also being made to their application to the technique of photography. (Copied complete from Abstract Section, Journal of the Textile Institute, Oct., 1931.) (S)

- - -

STARCH: ZYMOLYSIS.- D. T. Englis, G. T.Pfiefer and J. L. Gably.
Journal American Chemical Soc., 1931, 53, P. 1883-1889.

Samples of soluble starch were hydrolyzed by malt diastase and Taka diastase and the relationship between the specific rotation and copper reducing values was determined at intervals. The ratios found were different from those anticipated from theoretical considerations and indicate that the early stages of hydrolysis with Taka diastase are probably unlike those with malt diastase. It is probable that in the Taka diastase hydrolysis some glucose is formed from a saccharide unit other than maltose and that it may precede maltose or be formed simultaneously with it. Temperature, concentration of enzyme and buffering of the solution do not appear to have any significant effect on the ratio. While the ratios found were not constant, determinations of diastatic activity based upon the assumption of a constant value will probably not involve an error more serious than those from other sources in such procedures. (Copied complete from the Abstract Section, Journal of the Textile Institute, Oct., 1931.) (S)

- - -

STUDIES OF VISCOSE CROSS SECTIONS (concl.).- A. Jager.
Die Kunstseide, Oct., 1931, P. 352-356.

The cross section of viscose rayon is influenced by several factors. The most important factors are: Spinning bath, especially in the presence of sulphates of metals, ripening of the viscose solution, and detaching. It has been ascertained that a critical detachment exists for which cross sections of different degrees of fullness may be formed in the same total thread. The mode of preparation of the viscose and the use of different pulps do not affect the cross section. The method of examination of the cross sections used by the author is described at the end of the article. (S)

- - - - - -

BIBLIOGRAPHY

COLOR MEASUREMENTS IN PSYCHOLOGICAL TERMS.- Dorothy Nickerson.
Journal of the Optical Society of America, Oct., 1931, P. 643-650.

A discussion of the presentation of the data on comparative measurements of color using the Munsell notation. The statistical treatment of measurements on several different products including cotton is given. Table II gives a series of readings on several samples of cotton fibre in terms of hue, brilliance, chroma. There were 75 samples selected from the three grades. The usefulness of color measurements expressed in psychological terms (even though these may be approximate) is indicated. (S)

- - -

THE YUCCA, A NEW GERMAN FIBRE PLANT. (concl.).- Dr. K. Roos.
Melliand Textilberichte, Vol. XII-10, Oct., 1931, P. 621-622.

The article continues with a discussion of the alpha cellulose content of the fibre and the results of treatment with nitric and acetic acids. (S)

- - -

RESEARCH IN FLAX YARN FINISHING (cont'd).- G. Neumann.
Melliand Textilberichte, Vol. XII-10, Oct., 1931, P. 632-635.

A continuation of the discussion of flax yarn processing including a description of the experimental processing machine. (S)

- - -

ON THE USE OF HYDROGEN PEROXIDE IN THE TEXTILE INDUSTRY.- Leo Kollmann.
Melliand Textilberichte, Vol. XII-10, Oct., 1931, P. 637.

Reprint of a paper presented before the Congress of the International Federation of the Association of Chemists and Colorists, Paris, May, 1931. This article is a very brief review of the applications of this bleaching agent in textile work. (S)

- - -

COLOR, ITS APPEARANCE AND MEASUREMENT (concl.).- Fredrich Jacoby.
Melliand Textilberichte, Vol. XII-10, Oct., 1931, P. 641-643.

The article is largely a discussion of eleven charts concerned with various dyeings. (S)

- - -

COMPARATIVE RESEARCH ON CHARACTERISTICS OF CELLULOSE ACETATE AND THE ARTIFICIAL FIBRES MANUFACTURED FROM IT.- Fritz Ohl.
Melliand Textilberichte, Vol. XII-10, Oct., 1931, P. 647-651.

A comparison of four types of cellulose acetate as obtained from as many different manufacturers for reaction with methyl blue, reaction to heat, reaction with acids, viscosity, cross sectional shape, and moisture content. (S)

- - -

THE STEP-PHOTOMETER AS AN AID TO TEXTILE CHEMICAL RESEARCH (concl.).- H.Sommer.
Melliand Textilberichte, Vol. XII-10, Oct., 1931, P. 644-646.

This article continues with the study of the measurement of fading and ends with a discussion of the determination of lustre. (S)

- - -

MAINTENANCE OF RELATIVE HUMIDITIES ON A LABORATORY SCALE.- William G.Chace.
American Dyestuff Reporter, Vol. XX-19, Sept. 28, 1931, P. 615-617.

In this article the author gives two methods of maintaining small samples at definite humidities. Both methods allow of continuous variation of the relative humidity. Tables and graphs are given by which the proper concentration of the solutions for any degree of humidity may be determined. A humidity box is described which may be used as a substitute for a conditioning room. Advantages and disadvantages of the solution mentioned are discussed.(S)

- - -

PRACTICAL IDENTIFICATION OF ACETATE RAYON.
Textile Manufacturer, Vol. 57-681, Sept., 1931, P. 336.

A series of tests including one single operation test for general differentiation of rayon is given by K. Hahn of the National Aniline and Chemical Company, Inc. (S)

- - -

THE ANALYSIS OF TURKEY-RED OILS.
The Textile Manufacturer, Vol. 57-681, Sept., 1931, P. 338-339.

A scheme of analysis proposed by Wissenschaftliche Zentralstelle fur Oel- und Fettforschung and includes the following:

Qualitative Test for Sulphonation.
Determination of Fatty Acids.
Determination of Sulphuric Acid.
Acidity or Alkalinity.
Definition of Degree of Sulphonation.
Determination of Neutral Fats and Unsaponifiable Organic Matters.
Determination of Organic Solvents.
Determination of Water.
Volumetric Determination of Total Fatty Matters. (S)

- - -

THE DEVELOPMENT OF MILDEW ON WOOL.- R. Burgess.
American Dyestuff Reporter, Vol. XX-19, Sept. 28, 1931, P. 631-632, 643.
Reprinted from the Journal Society Dyers and Colorists.

A brief discussion is given of the influence of moisture, the nutritive properties of wool, resistance from chroming, micro-biological activity, and mildew prevention. (S)

- - -

ENZYMES AND THEIR APPLICATIONS IN THE TEXTILE INDUSTRIES.- S. R. Trotman.
American Dyestuff Reporter, Vol. XX-19, Sept. 28, 1931, P. 623-626.

An article reprinted from the "Dyer and Calico Printer" which includes the comparison of enzymes with inorganic catalysts, the occurrence of enzymes, the conditions for their action, the effect of pH, detection, types, finishing mixtures, starch and dextrin, etc. (S)

- - -

NEW AID IN COLOR MATCHING.
Melliand Textile Monthly, Vol. III-8, Nov., 1931, P. 645.

A brief description of the latest model of the Sheldon colorimeter illustrated by a halftone of the instrument. It is pointed out that the device may be used for rapid tests of match without the necessity for a color analysis of the sample. Texture effects, etc., are eliminated by rotating the samples rapidly. Color analysis in terms of the three primaries (three filters are employed) is still possible. Two photo-electric cells are employed. (S)

- - - - - -

"Survey of Textile Research in the United States, 1931"

Although the "Survey of Textile Research in the United States, 1931," that was conducted for The Textile Foundation by U. S. Institute, has not been released for distribution or publication, and will not be until the report has been indexed and published in convenient form, The Textile Foundation has kindly released for publication in this issue the summary of survey results as it appears in the original report of 130 pages. With such use in view sufficient extra copies of this chapter were mimeographed when the original report was prepared, and this accounts for the fact that, while this section is itself consecutively paged, it could not be paged as a consecutive part of this issue.

Explanatory Notes

The questionnaire that was used in this survey was designed to produce replies that would show the facilities of each concern for textile research and the character and scope of that research.

In the compilation of replies the concerns reporting research were classified in four major groups: Industrial, Commercial, Educational and Governmental. With the possible exception of the Industrial Group and the Commercial Group the titles are clearly explanatory of the character of laboratories thus listed.

The Industrial Group includes all industrial concerns reporting textile research. The Commercial Group is made up of laboratories engaged in textile research as a business. All of the reporting concerns are listed in master sheets in their respective groups, and arranged alphabetically by States.

- - -

SUMMARY OF SURVEY RESULTS

While the survey mailing list covered 1435 industrial concerns, commercial laboratories, educational institutions and government departments, of which 661 replied and 267 reported that they were engaged in textile research, it cannot be claimed that the returns provide complete coverage of all textile research in the country. That was its objective, however, and the returns are believed to prove that it has come as close to attaining this objective as is possible without a personal canvass.

The survey compares very favorably in percentage of replies, and to the credit of the textile industry in the number of concerns engaged in research, with a somewhat similar survey of 5000 concerns in 40 different industries that was conducted in 1928 by the Division of Engineering and Industrial Research of the National Research Council. This is fairly comparative only with the Industrial Group of this textile survey, as follows:

	Mailed	Replies	Reported Research
Textile Survey, Industrial Group	1,124	488(43%)	159(14%)
National Rsch. Council, 40 Industries	5,000	599(12%)	353(7%)

These statistics show that in units engaged in research the textile industry compares favorably with other leading industries, but in total annual expenditures for research it is

still among the backward industries.

The Industrial Group includes only seven concerns that are not solely identified with the manufacturing branch of the textile industry, and these seven, which are users of textiles, add to the statistical data only equipment and personnel actually engaged in textile research. Of the 159 units of this list 132 are textile manufacturers and machine builders. There might be added to this textile manufacturing list the textile schools and a number of commercial laboratories that are solely textile. Thus classified the research facilities and activities of the manufacturing end of the industry would compare even more favorably with those of other industries. But the purpose of this survey is to show the facilities for, and character of, all textile research in the country, and it is compiled along lines that are intended to present the collected data clearly and concisely.

Research Facilities

Reported as engaged in scientific research are 179 laboratories and 860 scientists; in manufacturing research 179 experimental plants and 476 graduate engineers or textile technologists; in research in testing methods 191, and in economic research 89 with a total of 126 economists or statisticians.

The wording of the questionnaire was assumed to make it plain that only facilities and research conducted with scientific method would qualify for inclusion in survey data. There is evidence that this was not clear to all who replied, particularly to some of the Industrial and Commercial groups. A few may have reported "Scientific Research" who are not engaged in fundamental work; a few may have checked "Manufacturing

Research" who are not provided with "experimental plant"; and some may have reported "Research in Testing Methods" who are merely engaged in routine testing. It has been impossible to eliminate all who were not believed to qualify, but it is believed that the number thus listed is fully offset by the few concerns engaged in textile research that did not reply.

Facilities for chemical research are considerably greater in the aggregate in all groups than for any other listed type of research, and particularly so in the Industrial and Commercial groups. Comparatively few mills report activities in research that are not engaged in chemical processing, and commercial laboratories specializing in chemical research predominate. On the other hand, subjects of researches reported by all groups are 56.68% physical and only 31.16% chemical. The percentage relation is about the same for researches in progress and for researches regarded as fundamental. The allowable inference is that the industry is weakest in research other than chemical, both as to facilities and personnel. The Educational and Government groups are relatively strong in physical research, and a large proportion of the physical facilities and scientists of those groups can be made easily available to the textile industry.

Most of the textile schools are well equipped with experimental plant for manufacturing research and with equipment for research in testing and in testing methods. Their facilities and instructing staffs, however, are, as a rule, too closely confined to scholastic work to allow much opportunity for scientific and fundamental research, or its direction. Plans by which more of this equipment and qualified personnel

could be made available for research along scientific lines would redound to the advantage of the industry, particularly if it provided provision for graduate research work.

Laboratory equipment reported available for all classes of research covered by the questionnaire is definitely indicated to be considerably in excess of present demand. This is particularly true of laboratories reporting in the Commercial and Educational groups, and also of those of certain government laboratories, notably the Bureau of Standards. Much of this equipment is idle because of lack of demand for textile research and of financing that would provide for its utilization by attracting a larger staff of scientists and qualified technologists. In addition to the type of laboratories classified in the questionnaire under scientific research as chemical, physical and microscopical, a number of commercial, educational and government reports note that equipment is available for research in biology, bio-chemistry, physical chemistry, genetics and other of the modern sciences.

Restriction of this survey to facilities actually engaged wholly or partially in textile research prevents inclusion of research facilities of other industries that have produced important fundamental knowledge applicable to textiles, and that may become sources of even more valuable basic facts for the textile researcher in the future. The dye and chemical industries naturally are thought of first in this connection, but the rayon researcher realizes that the next important discovery in cellulose may come from research of the pulp or paper industries, or, possibly, from the patient study of some scientist whose hobby is pure research. Fundamental knowledge of value

in solving the silk soaking problem might result from tanning industry research in hide soaking, which, by the way, has resulted in savings of millions of dollars to the latter industry. The scientist interested in proteins, or in the synthesis of wool or silk, might profit by the work of the cancer researcher. The true scientist realizes that the interdependence of fundamental research is far greater than that of industry. In a scientific sense many of these non-textile research facilities are as truly textile as those wholly engaged in textile research.

Economic research is reported by 89 of all groups, having available for such studies 126 statisticians or economists. Only 55 of those reporting this type of research are directly connected with textile manufacturing or merchandising. Much larger facilities undoubtedly are available for various types of economic textile research than are definitely reported in this survey as actually engaged therein.

That 130 of the 159 concerns of the Industrial Group reporting research should be located in the New England and Middle Atlantic States is not surprising in view of the fact that this distribution of research activities is closely proportional to the number of mills located in those sections as compared with those in the whole country. Research facilities naturally follow the demand.

It may be inferred fairly that this survey shows facilities that should be ample to meet present apparent demand for the types of textile research definitely covered by the survey, provided the reported facilities are properly coordinated thru some central cooperative agency fairly representative of all interested groups, and until such time as the industry provides a central textile research laboratory adequately equipped, staffed and financed.

Character and Scope of Research

The character of present and projected research is most accurately shown by the survey list of reported researches. This in part is because laboratories and personnel reported in questionnaire replies as engaged in textile research are shown by a considerable number of replies to include much equipment and many researchers not actively employed therein, although available for it.

The 584 subjects of research reported by 85 concerns are 57% physical, 31% chemical and less than 10% economic. Physical subjects are largely in excess of chemical in all but the Commercial Group, which is surprising because in all groups chemists available for research are far in excess of physicists. Of 137 researches reported in progress by 30 concerns the percentage of chemical and physical subjects is about the same as for all research reported, but of those that may be classed as fundamental the number of chemical and physical researches reported in progress is almost identical.

This impels the inference that research in chemical subjects is discouraged by realization that greater fundamental knowledge is needed for which adequate financing has been unavailable; also that, while fundamental research is an equal need on the physical side, this fact has not yet checked individual efforts to solve the industry's numerous physical problems with the tools and facts available.

With so many widely scattered and unrelated laboratories engaged in research, many of them upon a private basis, it is not surprising that there should have been a considerable duplication of effort upon identical or similar subjects. Duplication of effort in pure research is to be commended and it is

not necessarily wasteful in other types of research. The exigencies of competition will assure more or less duplication of research effort in the private work of manufacturers, and also in commercial, educational and governmental laboratories whose services are retained by manufacturers. Many industrial and commercial laboratories, however, and most educational and government laboratories desire to avoid unnecessary duplication of effort as far as possible, and this can be prevented in large part by contact through some central association of those engaged in research, and by regular publication of research bibliography and abstracts.

More wasteful than duplication of researches in progress is the duplication of completed research work. A considerable number of the subjects listed in "Reported Researches" are of this character. Instances of such duplication are most numerous in the Industrial and Educational groups, particularly among users of textiles and home economics departments of colleges. They are regrettable evidences of the present lack of reliable textile technological literature, and of a central library that is a source of both textile research literature and information.

A very large part of the researches reported by the textile schools, institutes of technology, and a few other educational institutions, represents undergraduate and graduate thesis work for degrees. Nearly all of this work is praiseworthy as to subject, and would constitute a valuable addition to the industry's new knowledge if more of it were carried to completion. Unfortunately, comparatively few of these theses cover completed research. This is also true of most of the

college research conducted on the fellowship plan. In the case of the latter, however, the cause is most often inadequate financing.

The list of reported researches that represent thesis work of textile school and college students indicates that the selection of live subjects by some central research body might prevent unnecessary duplication of effort, and make studies more resultful. The selection of talented students for continuance of their researches on the graduate fellowship plan is also indicated as worthy of consideration. The graduate fellowship research plan of educational institutions,which provide adequate facilities and the advisory cooperation of scientists of their instructing staffs, not only supplies effective research at nominal cost, but has the merit of training a supply of researchers for later work in industry. Like the associate plan of certain college, commercial and government laboratories, however, it needs the assurance of adequate financing to encourage the worker, and also the cocperation of a central textile research body in advisory and correlating capacities.

Only four concerns or associations reporting economic research subjects are strictly textile, although several other economic researches reported by commercial concerns and colleges were financed by manufacturers or their associations. In proportion to reported facilities for economic research the number of concerns reporting and the number of subjects reported are much smaller than for other types of research. This does not prove that need for such research is not vital, but it does demonstrate that interest in it is not well defined or vital, and indicates that much educational work will be necessary to arouse the industry to its need and value.

It seems significant in this connection that in industries whose merchandising ability is highly efficient there is constant pressure from the selling end for something new or improved to sell. The research that develops the new fundamental knowledge that is the basis of new products must anticipate increased skill in merchandising.

The fact that fundamental research is generally acknowledged to be one of the textile industry's greatest needs has been accepted as a sufficient excuse for providing a list of reported researches that seemed to qualify as being fundamental. A total of 54 researches are thus classified, of which ten are reported by the Industrial, five by the Commercial, 25 by the Educational and 14 by the Government group. Of the total, 28 are physical and 19 are chemical in character, and of the remaining seven the majority are both chemical and physical. In both subject and number this group of reported researches inadequately reflects the industry's need of fundamental research, yet is sufficiently large to demonstrate that the need is very generally realized. Promotion of fundamental textile research is one of the major activities of the United States Institute for Textile Research, Inc.

It seems significant that most of the research that is not fundamental is private in character, while that which is fundamental is largely cooperative through associations, or on the fellowship or associate plan through educational institutions, commercial laboratories or government bureaus. This coincides with the experience of other industries whose units, like those of the textile industry, are comparatively small. Fundamental research is so uncertain of being resultful, and

is likely to be so protracted and expensive, as to discourage any but the largest private concerns from undertaking it. For the textile industry particularly, with its more than 7,000 individual units, cooperative effort is the logical means of providing the fundamental research that is needed to develop the new knowledge that will be the source of new products, and of new uses and new adaptations for old products.

Under "Research Facilities" the importance to the textile industry of many fundamental discoveries of other industrial researchers and scientists is mentioned. The vitally important thing in this connection is that accurate and comprehensive bibliography and abstracts of such outside researches having possible textile application be made available to textile researchers. That is one of the major activities of U. S. Institute for Textile Research, Inc.

With such large available supplies of facilities and skilled personnel in commercial, educational and government laboratories their utilization in cooperative research, fundamental or otherwise, would seem to be the quickest and cheapest path toward the desired goal, the ultimate ideal being a central group of laboratories directed and financed cooperatively by the industry.